

40V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET
Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(on)}$ max	I_D max (A) $T_A = 25^\circ\text{C}$ (Notes 3 & 5)
Q1	40V	25m Ω @ $V_{GS} = 10\text{V}$	7.5
		40m Ω @ $V_{GS} = 4.5\text{V}$	6.2
Q2	-40V	25m Ω @ $V_{GS} = -10\text{V}$	-7.3
		45m Ω @ $V_{GS} = -4.5\text{V}$	-5.7

Description and Applications

This MOSFET has been designed to ensure that $R_{DS(on)}$ of N and P channel FET are matched to minimize losses in both arms of the bridge. The DMC4040SSD is optimized for use in 3 phases brushless DC motor circuits (BLDC), CCFL backlighting.

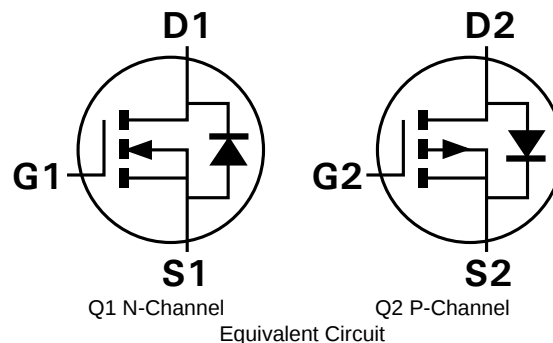
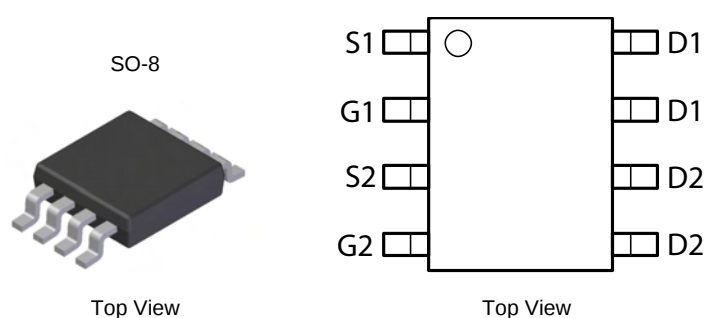
- 3 phases BLDC motor
- CCFL backlighting

Features and Benefits

- Matched N & P $R_{DS(on)}$ - Minimizes power losses
- Fast switching – Minimizes switching losses
- Dual device – Reduces PCB area
- "Green" component and RoHS compliant (Note 1)
- Qualified to AEC-Q101 Standards for High Reliability

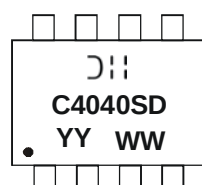
Mechanical Data

- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208
- Weight: 0.074 grams (approximate)


Ordering Information (Note 1)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DMC4040SSD-13	C4040SD	13	12	2,500

Note: 1. Diodes, Inc. defines "Green" products as those which are RoHS compliant and contain no halogens or antimony compounds; further information about Diodes Inc.'s "Green" Policy can be found on our website. For packaging details, go to our website.

Marking Information


⌋⌋ = Manufacturer's Marking
 C4040SD = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 10 = 2010)
 WW = Week (01 - 53)

Maximum Ratings @T_A = 25°C unless otherwise specified

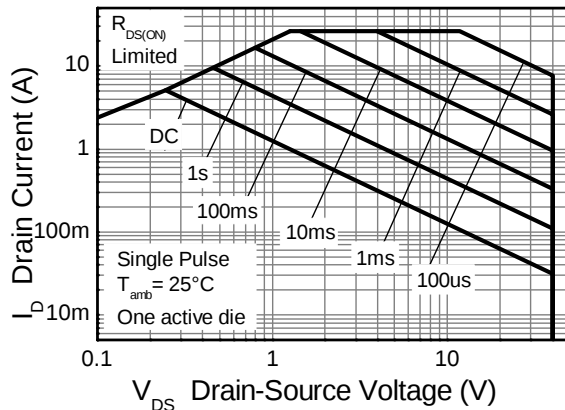
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Drain-Source Voltage			V _{DSS}	40	-40	V
Gate-Source Voltage			V _{GSS}	±20	±20	
Continuous Drain Current	V _{GS} = 10V	(Notes 3 & 5)	I _D	7.5	-7.5	A
		T _A = 70°C (Notes 3 & 5)		5.8	-5.8	
		(Notes 2 & 5)		5.7	-5.7	
		(Notes 2 & 6)		6.8	-6.8	
Pulsed Drain Current	V _{GS} = 10V	(Notes 4 & 5)	I _{DM}	29.0	-29.0	
Continuous Source Current (Body diode)		(Notes 3 & 5)	I _S	3.0	-3.0	
Pulsed Source Current (Body diode)		(Notes 4 & 5)	I _{SM}	29.0	-29.0	

Thermal Characteristics @T_A = 25°C unless otherwise specified

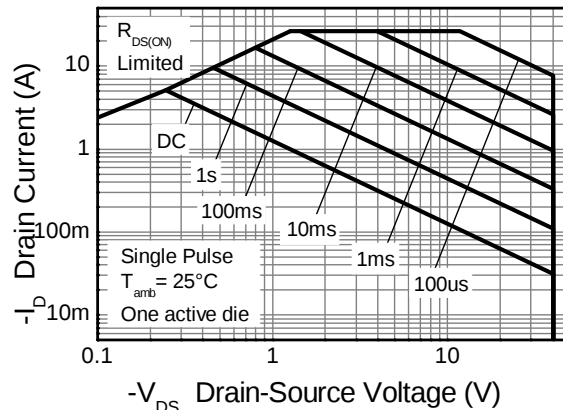
Characteristic		Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 2 & 5)	P _D	1.25		W mW/°C
			10		
	(Notes 2 & 6)		1.8		
	(Notes 3 & 5)		14.3		
Thermal Resistance, Junction to Ambient	(Notes 2 & 5)	R _{θJA}	2.14		°C/W
	(Notes 2 & 6)		17.2		
	(Notes 3 & 5)		100		
Thermal Resistance, Junction to Lead	(Notes 2 & 6)	R _{θJL}	70		
	(Notes 3 & 5)		58		
Operating and Storage Temperature Range		T _J , T _{STG}	51	-55 to +150	°C

- Notes:
- For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
 - Same as note (2), except the device is measured at t ≤ 10 sec.
 - Same as note (2), except the device is pulsed with D = 0.02 and pulse width 300μs.
 - For a dual device with one active die.
 - For a device with two active die running at equal power.
 - Thermal resistance from junction to solder-point (at the end of the drain lead).

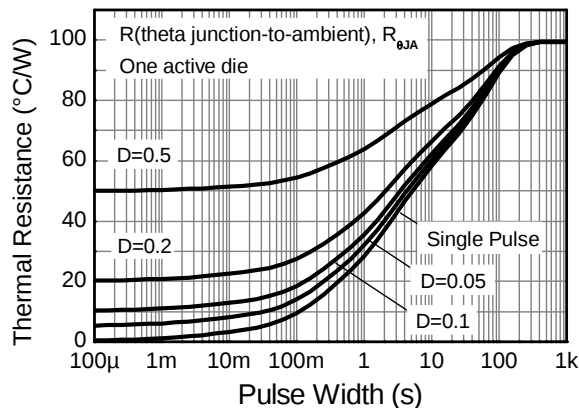
Thermal Characteristics



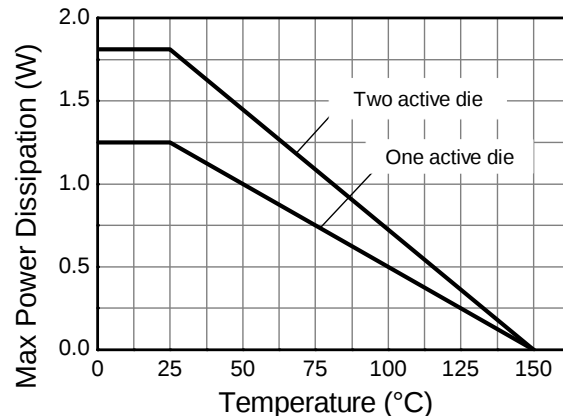
N-channel Safe Operating Area



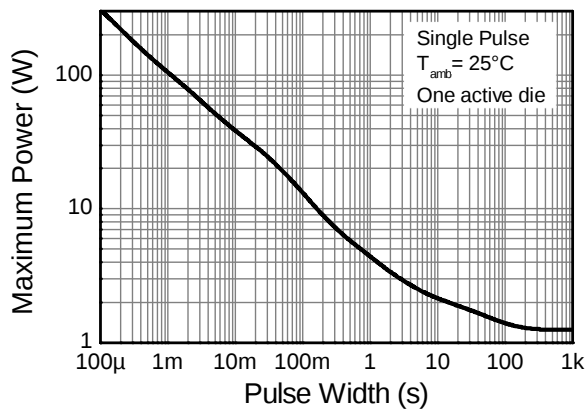
P-channel Safe Operating Area



Transient Thermal Impedance



Derating Curve



Pulse Power Dissipation

Electrical Characteristics – Q1 N-CHANNEL @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	40	—	—	V	I _D = 250μA, V _{GS} = 0V
Zero Gate Voltage Drain Current	I _{DSS}	—	—	1.0	μA	V _{DS} = 40V, V _{GS} = 0V
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, V _{DS} = 0V
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(th)}	0.8	1.3	1.8	V	I _D = 250μA, V _{DS} = V _{GS}
Static Drain-Source On-Resistance (Note 8)	R _{DS(on)}	—	0.013	0.025	Ω	V _{GS} = 10V, I _D = 3A
			0.028	0.040		V _{GS} = 4.5V, I _D = 3A
Forward Transconductance (Notes 8 & 9)	g _{fs}	—	12.6	—	S	V _{DS} = 5V, I _D = 3A
Diode Forward Voltage (Note 8)	V _{SD}	—	0.7	1.0	V	I _S = 1A, V _{GS} = 0V
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C _{iss}	—	1790	—	pF	V _{DS} = 20V, V _{GS} = 0V f = 1MHz
Output Capacitance	C _{oss}	—	160	—		
Reverse Transfer Capacitance	C _{rss}	—	120	—		
Gate Resistance	R _g	—	1.03	—	Ω	V _{DS} = 0V, V _{GS} = 0V, f = 1MHz
Total Gate Charge (Note 10)	Q _g	—	16.0	—	nC	V _{GS} = 4.5V V _{DS} = 20V I _D = 3A
Total Gate Charge (Note 10)	Q _g	—	37.6	—		
Gate-Source Charge (Note 10)	Q _{gs}	—	7.8	—		
Gate-Drain Charge (Note 10)	Q _{gd}	—	6.6	—		
Turn-On Delay Time (Note 10)	t _{D(on)}	—	8.1	—	ns	V _{DD} = 20V, V _{GS} = 10V I _D = 3A
Turn-On Rise Time (Note 10)	t _r	—	15.1	—		
Turn-Off Delay Time (Note 10)	t _{D(off)}	—	24.3	—		
Turn-Off Fall Time (Note 10)	t _f	—	5.3	—		

Notes: 8. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
 9. For design aid only, not subject to production testing.
 10. Switching characteristics are independent of operating junction temperatures.

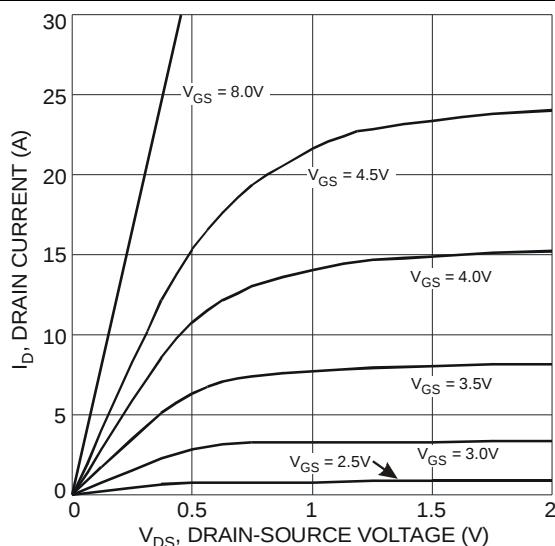
Typical Characteristics – Q1 N-Channel


Fig. 1 Typical Output Characteristic

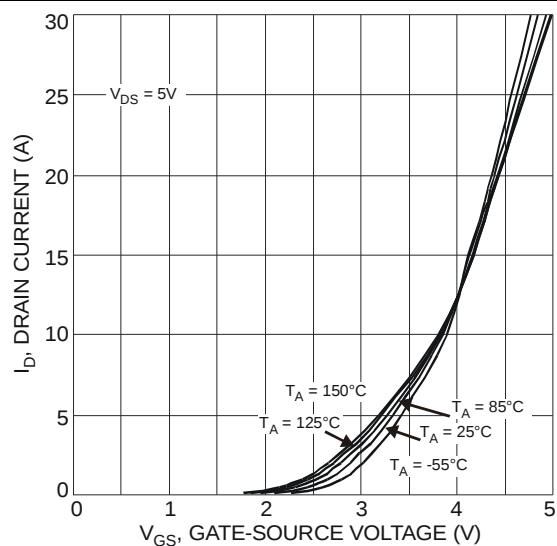


Fig. 2 Typical Transfer Characteristic

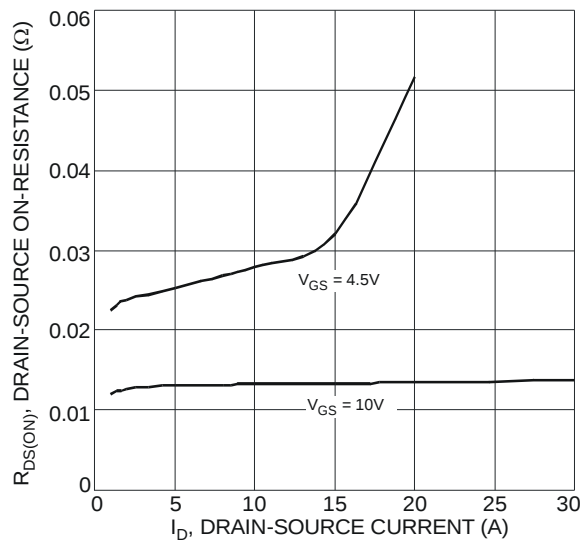


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

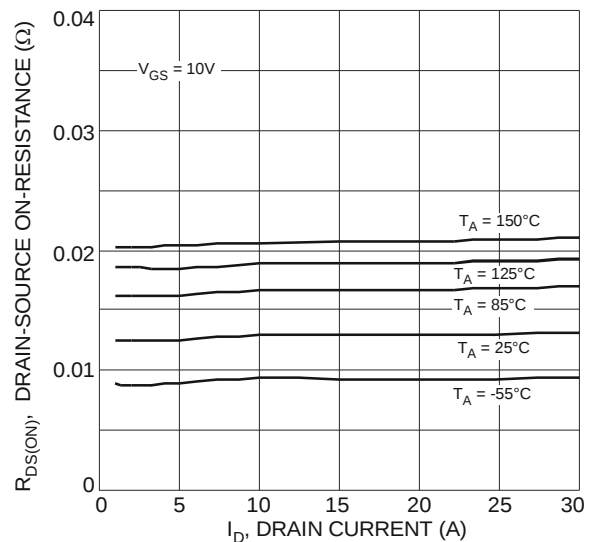


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

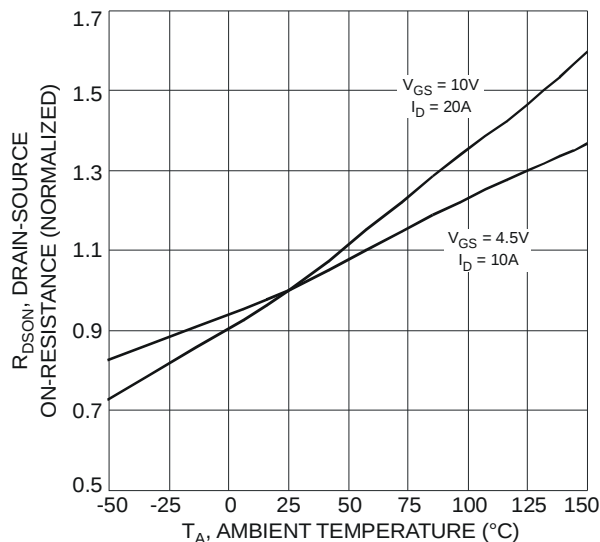


Fig. 5 On-Resistance Variation with Temperature

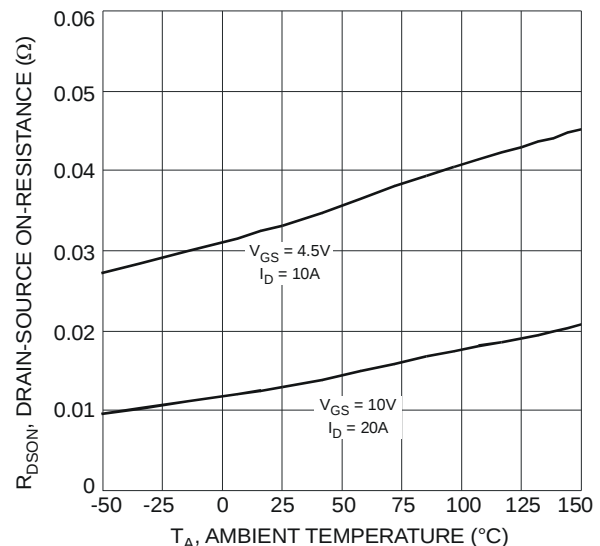


Fig. 6 On-Resistance Variation with Temperature

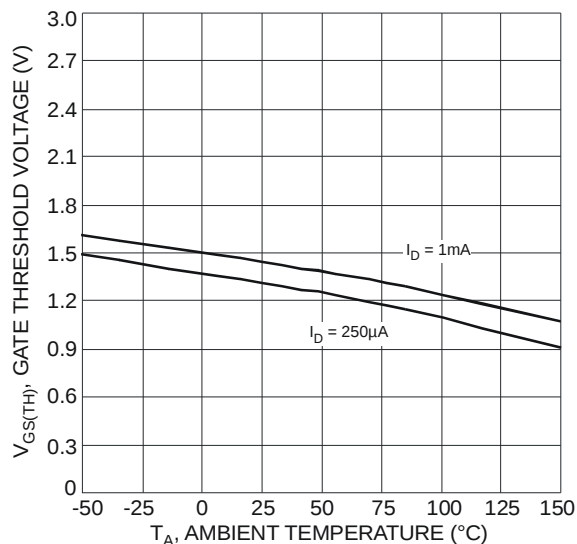


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

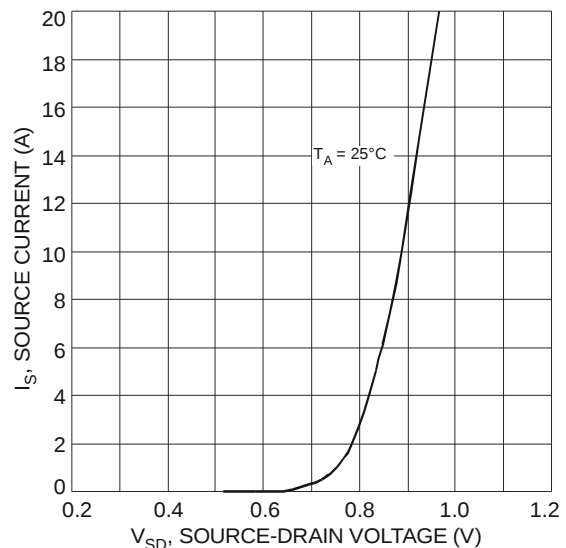
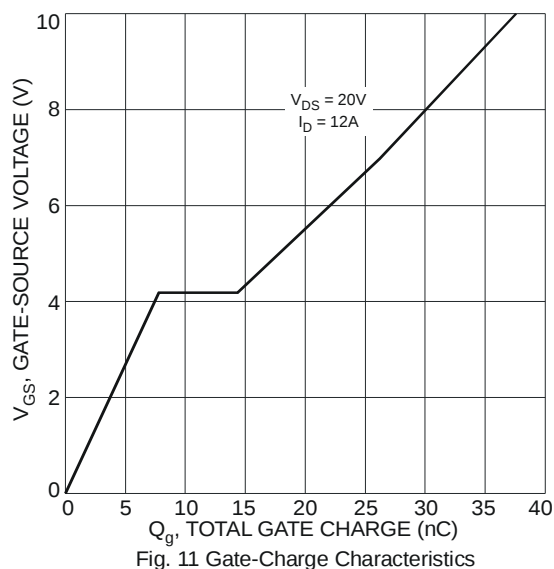
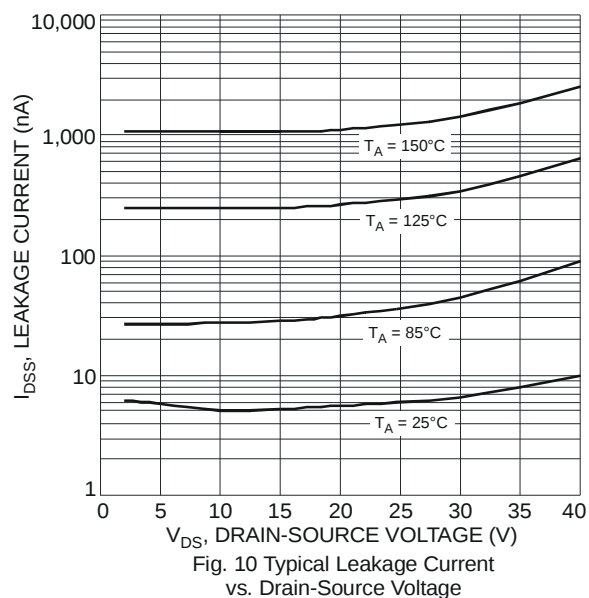
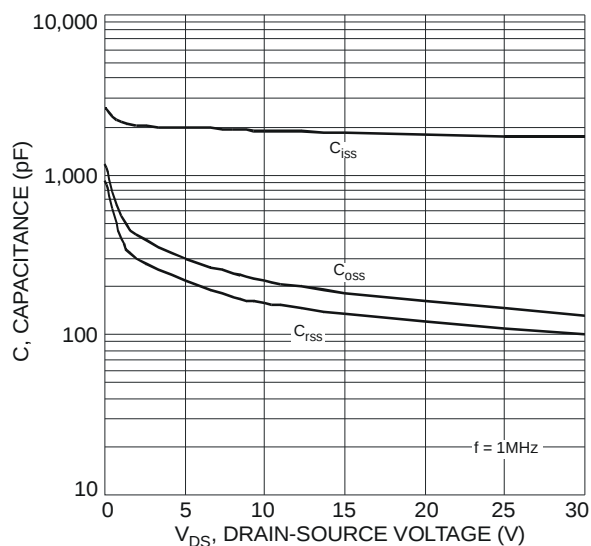


Fig. 8 Diode Forward Voltage vs. Current



Electrical Characteristics – Q2 P-CHANNEL @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	-40	–	–	V	I _D = -250μA, V _{GS} = 0V
Zero Gate Voltage Drain Current	I _{DSS}	–	–	-1.0	μA	V _{DS} = -40V, V _{GS} = 0V
Gate-Source Leakage	I _{GSS}	–	–	±100	nA	V _{GS} = ±20V, V _{DS} = 0V
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(th)}	-0.8	-1.3	-1.8	V	I _D = -250μA, V _{DS} = V _{GS}
Static Drain-Source On-Resistance (Note 11)	R _{DS(on)}	–	0.018	0.025	Ω	V _{GS} = -10V, I _D = -3A
			0.030	0.045		V _{GS} = -4.5V, I _D = -3A
Forward Transconductance (Notes 11 & 12)	g _{fs}	–	16.6	–	S	V _{DS} = -5V, I _D = -3A
Diode Forward Voltage (Note 11)	V _{SD}	–	-0.7	-1.0	V	I _S = -1A, V _{GS} = 0V
DYNAMIC CHARACTERISTICS (Note 12)						
Input Capacitance	C _{iss}	–	1643	–	pF	V _{DS} = -20V, V _{GS} = 0V f = 1MHz
Output Capacitance	C _{oss}	–	179	–		
Reverse Transfer Capacitance	C _{rss}	–	128	–		
Gate Resistance	R _g	–	6.43	–	Ω	V _{DS} = 0V, V _{GS} = 0V, f = 1MHz
Total Gate Charge (Note 13)	Q _g	–	14.0	–	nC	V _{DS} = -20V I _D = -3A
Total Gate Charge (Note 13)	Q _g	–	33.7	–		
Gate-Source Charge (Note 13)	Q _{gs}	–	5.5	–		
Gate-Drain Charge (Note 13)	Q _{gd}	–	7.3	–		
Turn-On Delay Time (Note 13)	t _{D(on)}	–	6.9	–	ns	V _{DD} = -20V, V _{GS} = -10V I _D = -3A
Turn-On Rise Time (Note 13)	t _r	–	14.7	–		
Turn-Off Delay Time (Note 13)	t _{D(off)}	–	53.7	–		
Turn-Off Fall Time (Note 13)	t _f	–	30.9	–		

Notes: 11. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
12. For design aid only, not subject to production testing.
13. Switching characteristics are independent of operating junction temperatures.

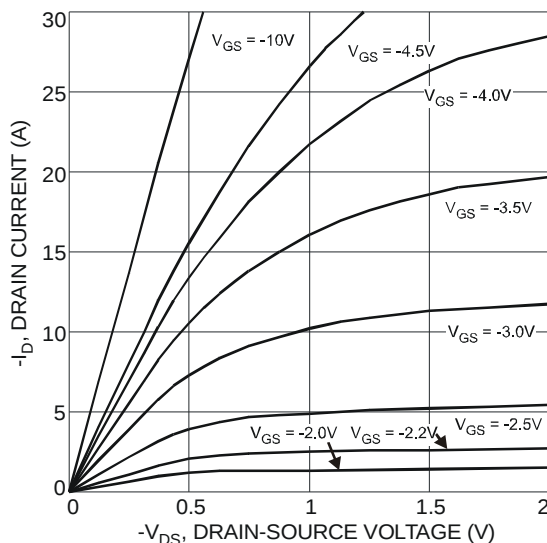
Typical Characteristics – Q2 P-Channel


Fig. 12 Typical Output Characteristic

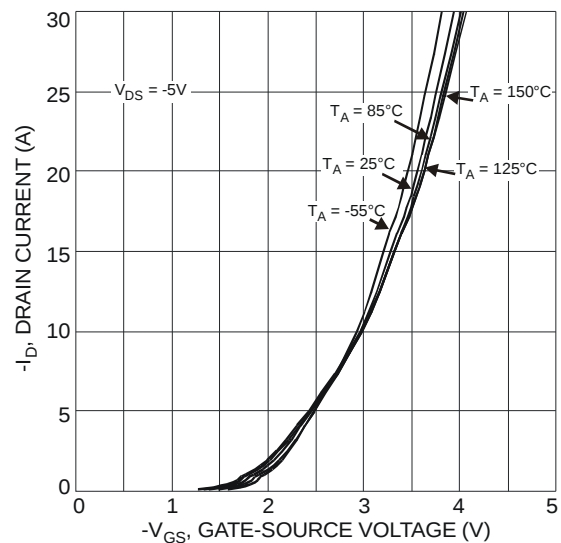


Fig. 13 Typical Transfer Characteristic

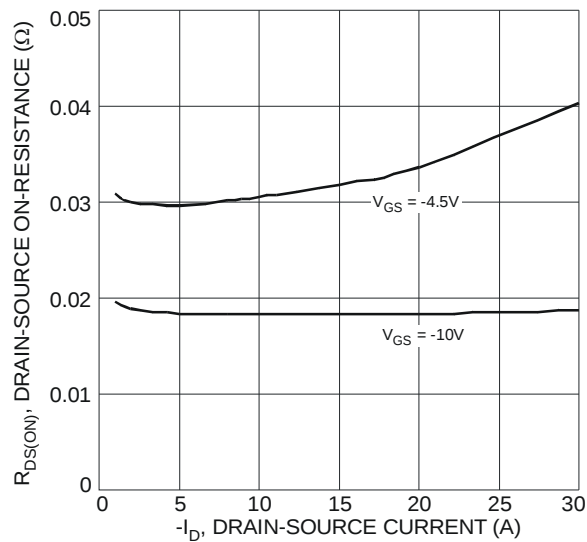


Fig. 14 Typical On-Resistance vs. Drain Current and Gate Voltage

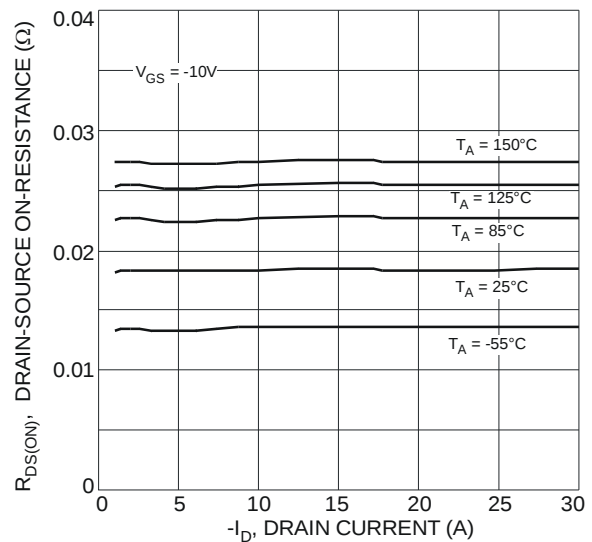


Fig. 15 Typical On-Resistance vs. Drain Current and Temperature

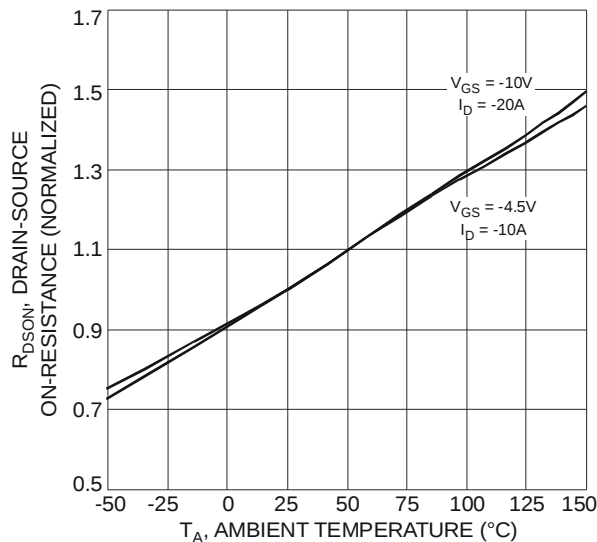


Fig. 16 On-Resistance Variation with Temperature

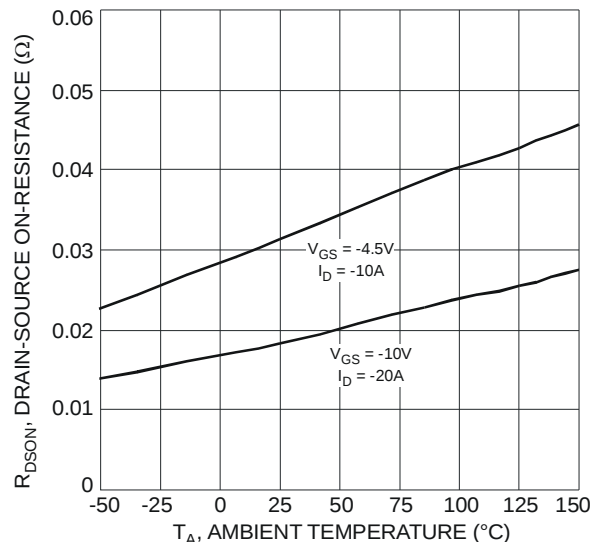


Fig. 17 On-Resistance Variation with Temperature

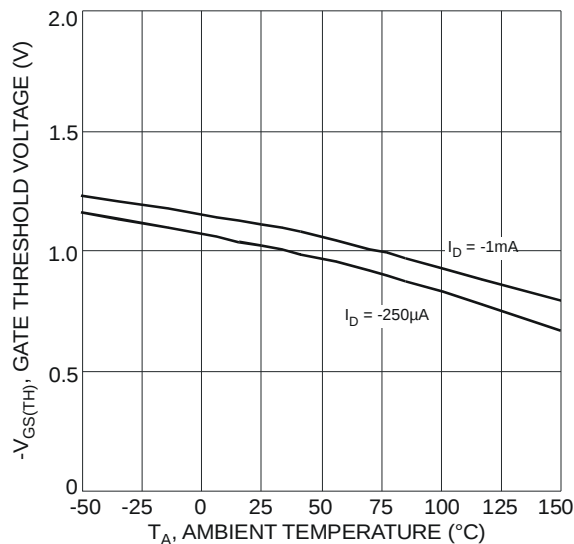


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

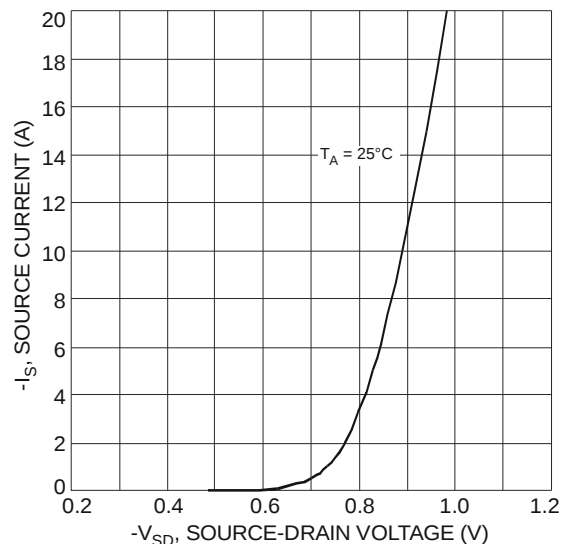
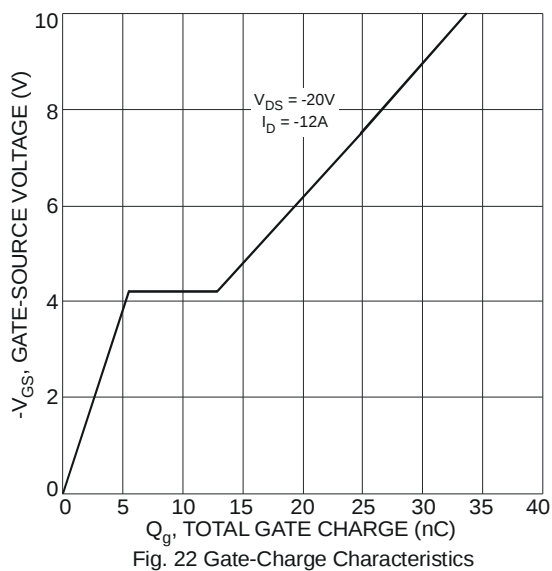
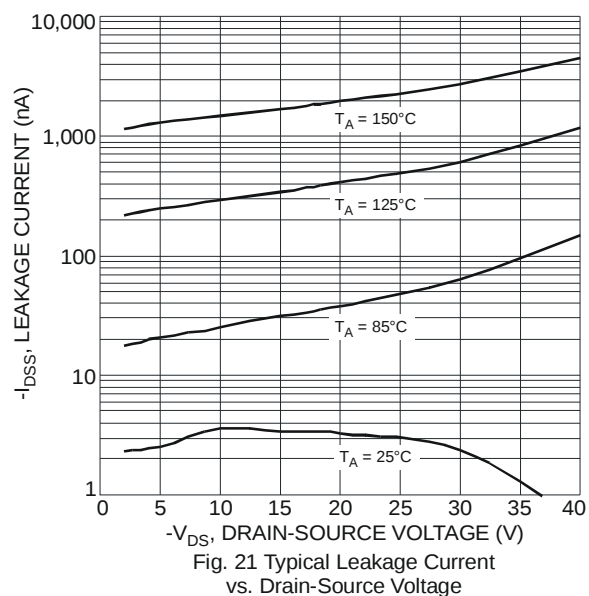
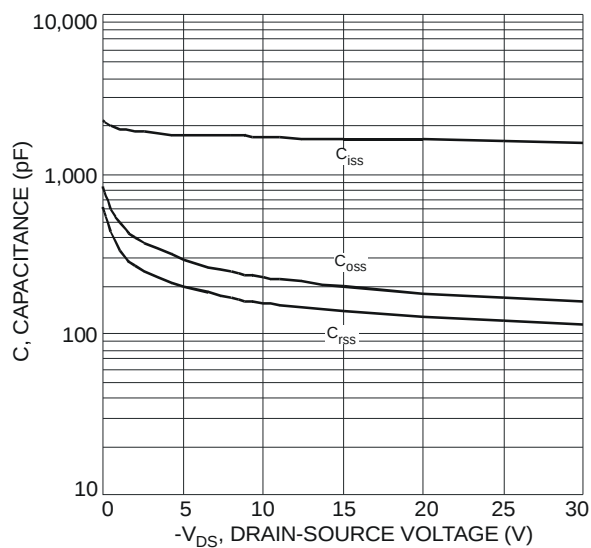
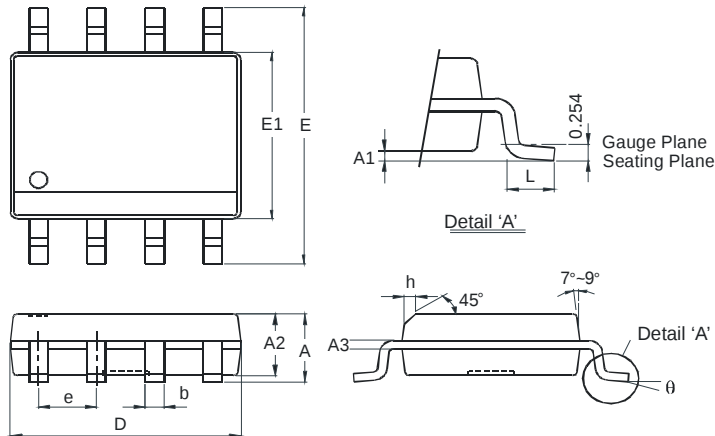


Fig. 19 Diode Forward Voltage vs. Current

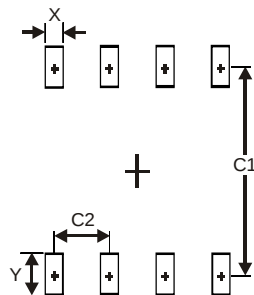


Package Outline Dimensions



SO-8		
Dim	Min	Max
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°
All Dimensions in mm		

Suggested Pad Layout



Dimensions	Value (in mm)
X	0.60
Y	1.55
C1	5.4
C2	1.27

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